

# NASA TECH BRIEF

## *Marshall Space Flight Center*



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

### **Marshall Vehicle-Engineering Simulation System [MARVES]**

#### **The problem:**

The standardization of trajectory simulation programs needed to be implemented to allow better communication concerning these programs.

#### **The solution:**

The Marshall Vehicle-Engineering Simulation System (MARVES) was developed to furnish programmers with a standardized system for handling the digital computer simulation of trajectories.

#### **How it's done:**

The MARVES system is a computer language developed to aid in the solution of problems related to dynamic systems that can be described by a system of ordinary differential equations. The MARVES system contains a collection of models which represent the problem to be solved and a description of one or more events peculiar to the problem.

The simulation of dynamic systems on a computer requires a numerical method of integrating differential equations and a method of interrupting the integration to introduce discrete changes in the mathematical model. These requirements have led to the development of six basic processes:

1. The initialization process consists of reading input data, computing certain parameters which remain constant thereafter, such as starting conditions for the integration process, and setting certain logical constants.
2. The evaluation process consists of evaluating the differential equations.
3. The numerical-integration process consists of providing a numerical procedure whereby the differential equations may be evaluated stepwise until stopping conditions have been reached.
4. The interrupt process consists of providing a method of interrupting the integration procedure when certain conditions are satisfied or when changes in dynamics are to be made.

5. The end-of-step process consists of evaluating variables at the end of each integration step.
6. The termination process consists of satisfying given stopping conditions, making needed terminal computations.

The primary function of the MARVES language is to provide source statements which specify operations that tailor the program to suit a particular application. These statements furnish a shorthand notation for specifying: (1) the method of numerical integration, (2) the conditions under which the numerical integration is to be interrupted for special-event computation, and (3) input/output statements that are easy to code and debug. The MARVES processor program accepts MARVES statements, converts them to FORTRAN code, and then executes the FORTRAN program in the same manner as any other FORTRAN program.

#### **Notes:**

1. This program was written in ASA Standard FORTRAN to be implemented on any machine that has the correct compiler.
2. Inquiries concerning this program should be directed to:

COSMIC  
112 Barrow Hall  
University of Georgia  
Athens, Georgia 30601  
Reference: MFS-21701

Source: W. E. Keenum of  
Computer Sciences Corp.  
(MFS-21701)

Categories: 06 (Mechanics)  
09 (Mathematics and  
Information Sciences)  
03 (Physical Sciences)